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FMC Corporation

Phosphorus Chemicals Division
PO Box 4111
Pocatello, Idaho 83205
(208) 236-8200

FMC

OP-FTIR Air Monitoring System Annual Report 2001

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3/1/02
58

FMC Corporation

Phosphorus Chemicals Division
PO Box 4111
Pocatello, Idaho 83205
(208) 236-8200

FMC

February 28, 2002

RECEIVED
MAR 01 2002

Ms. Sylvia Burges
Region 10
Environmental Protection Agency
1200 Sixth Avenue
Seattle, Washington 98101

Re: 2001 Annual Report for the OP-FTIR Air Monitoring System
FMC Pocatello Plant
RCRA #IDD070929518

Dear Ms. Burges,

The 2001 Annual Report for the Open Path FTIR Air Monitoring System is enclosed. A copy has also been sent to the Shoshone-Bannock Tribes.

The enclosed Annual Report still references Astaris as the operator, which is correct for the 2001 time period. EPA and the Tribes have been informed that FMC Idaho LLC became the owner/operator of the Pocatello Plant as of February 2002.

If you have any questions please call me at (208) 236-8212.

Sincerely,

JP Sieverson

James P. Sieverson
FMC Environmental Manager

cc. Shoshone-Bannock Tribes – Susan Hanson

bcc.	Rob Hartman	w/Attachments w/oCD
	Jose' Bunzow	w/Attachments w/o CD
	D. Heineck	w/o Attachments or CD
	V. Berti	w/o attachments or CD
	B. Kricks	w/o attachments or CD
	File: 10.13.4	w/attachments and CD

Astaris Pocatello Plant
OP-FTIR Air Monitoring System

2001 Annual Report

TABLE OF CONTENTS

Astaris Pocatello Plant
OP-FTIR Air Monitoring System
2001 Annual Report

Section 1 – INTRODUCTION

This report provides the results from the Astaris OP-FTIR Air Monitoring System for 2001. This was the third year of operations. This report is divided into four sections –an introduction, a summary of maintenance and operation activities, data presentation and analysis, and presentation of quality assurance and control information.

The OP-FTIR Air Monitoring System consists of complete coverage of all sides of Ponds 17 and Pond 18-cells A and B by employing two open-path FTIR (OP-FTIR) systems for each pond. Each OP-FTIR system scans two adjacent sides of a pond on a cyclic basis. A 5-minute averaged measurement consists of 178 good scans. Complete cycle time for two beam paths is 10 minutes (five minutes each leg). The Unisearch FTIR systems employed for this project are bistatic systems with one interferometer and infrared (IR) source serving two beam paths through the use of a sliding mirror optical system that alternately directs the modulated IR beam to each of two receiver telescopes. Each receiver scope contains transfer optics and a mercury-cadmium-telluride (MCT) detector and is connected to the control computer and interferometer via fiber optic linkage. Each receiver also includes a liquid nitrogen system to supply liquid nitrogen to the MCT detector, which operates at about 78 degrees Kelvin. Figure 1 depicts the system set-up and identifies system beam paths. Beam path elevations are set from 6 to 8 feet above grade. This is based on the need to intercept the major portion of the pond plumes and the need to be as close as practical to breathing zones while allowing for normal facility operations to proceed without extended beam path blockages occurring.

The results of the OP-FTIR studies conducted previously were used to define the initial target compound and interferant compound list for the pond OP-FTIR air monitoring system. Target compounds are phosphine (PH_3), hydrogen cyanide (HCN), methane (CH_4), ammonia (NH_3), and hydrogen fluoride (HF). Interferant compounds are carbon monoxide (CO), carbon dioxide (CO_2), and water vapor (H_2O). Nitrous oxide (N_2O) will be measured for quality assurance purposes.

Astaris has also installed a 10-meter meteorological tower (shown on Figure 1) instrumented to monitor wind speed, wind direction, temperature, pressure, delta temperature, relative humidity, precipitation, and solar insolation in the pond area vicinity. Meteorological Solutions, Inc. supplied the meteorological system. The meteorological system consists of Met One sensors for barometric pressure, relative humidity, precipitation, and solar radiation; R.M. Young sensors for temperature and delta temperature; and Climatronics sensors for wind speed and wind direction. A Campbell Scientific CR23X data logger was included to record and prepare the data for transmission to the monitoring system network computer. The wind speed and wind direction sensors are equipped with external heaters to prevent wintertime freeze-ups. The temperature, pressure, wind speed, and wind direction signals for all six OP-FTIR systems are directly integrated into each system's spectral database via the fiber optic interface at the base station computer. All four OP-FTIR units are linked via fiber optics cable to a base station computer. The base PC supports a local area network (Ethernet) that polls all remote OP-FTIR units and meteorological station, extracts information, sorts and displays information, and provides for data reports compilation. The base PC is accessible via modem to provide remote data reporting access and to allow remote interrogation of individual OP-FTIR units for maintenance. A hardwire link is also in place to transmit OP-FTIR and meteorological data to the Main Security office for response to readings at or above action levels.

The following are the goals and objectives for the program:

1. 95% Annual data recovery exclusive of time required for normal maintenance, quality assurance, system start-up, and data loss due to adverse weather conditions preventing signal reception.

2. Detection of all emissions of the target compounds for this program from the active pond areas being monitored and assessment of emission changes with time and with changes in pond chemistry.

3. Maintenance and operation of the instrumentation employed in the program at levels to produce data of known quality with data accuracy goals of 70% or better, and data precision goals of 95% or better.

Section 2 - MAINTENANCE SUMMARY

2.1 Normal Operations and Maintenance

OP-FTIR site checks are performed on a daily basis both remotely and directly. Site checks are done remotely by accessing each individual OP-FTIR via a software program called pcANYWHERE32. Viewing the software screens, which are available upon remote connection, allows for the instrument status to be checked. The real time data displayed on each screen are reviewed for reasonableness of values, outliers, and data trends, which are indicative of potential malfunctions. A daily check form is filled out each day and is shown in Attachment A. The information recorded on each daily check form aids in assessing any malfunctions of the OP-FTIR systems. When malfunctions of the OP-FTIR are detected, an assessment of the problem is done by directly going to the location of concern.

Direct site checks are done as follows: Liquid nitrogen systems are inspected daily for proper functioning. Liquid nitrogen tank levels are checked daily and tanks are replaced

OP–FTIR AIR MONITORING SYSTEM CONFIGURATION

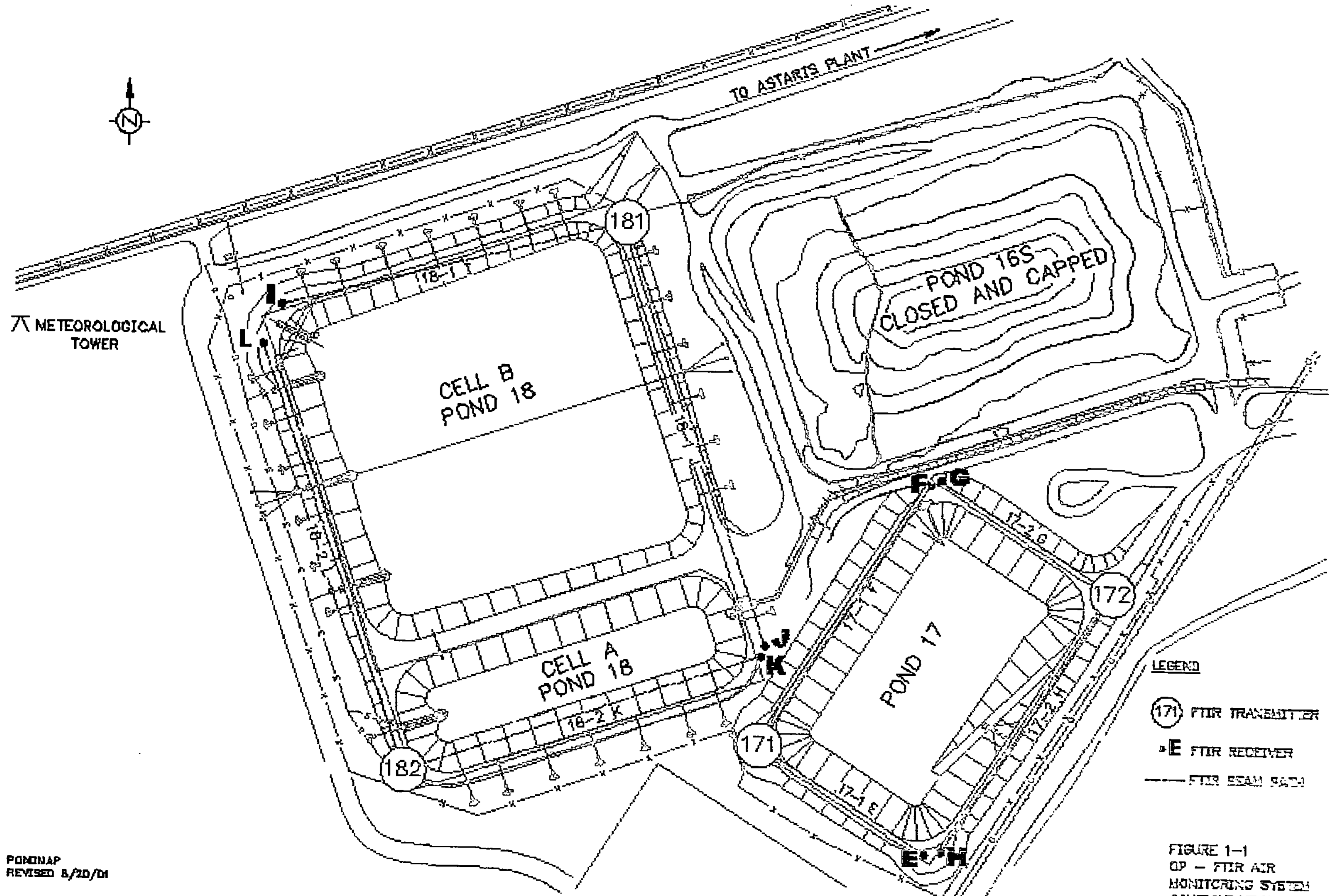


Figure 1

FTIR DAILY CHECKLIST

Weather: Date: Time: Technician:

OP-FTIR Location	17-1-1 (E) South Beam 1	17-1-2 (F) West Beam 2	17-2-1 (G) North Beam 1	17-2-2 (H) East Beam 2	18-1-1 (I) North Beam 1	18-1-2 (J) East Beam 2	18-2-1 (K) South Beam 1	18-2-2 (L) West Beam 2
Last Status Time								
Last SCAN Time								
Minimum Voltage								
Maximum Voltage								
Bad Scans								
N_2O value								
CH_4 value								
FTIR Fail Alarms								
Data Relay OPEN								
PPA State		Comments:						

Weather: Date: Time: Technician:

OP-FTIR Location	17-1-1 (E) South Beam 1	17-1-2 (F) West Beam 2	17-2-1 (G) North Beam 1	17-2-2 (H) East Beam 2	18-1-1 (I) North Beam 1	18-1-2 (J) East Beam 2	18-2-1 (K) South Beam 1	18-2-2 (L) West Beam 2
Last Status Time								
Last SCAN Time								
Minimum Voltage								
Maximum Voltage								
Bad Scans								
N_2O value								
CH_4 value								
FTIR Fail Alarms								
Data Relay OPEN								
PPA State		Comments:						

Attachment A

when necessary to avoid warming of detectors, which could result in downtime for a particular instrument.

Concentration data are collected each week using pcANYWHERE32 and archived. These data are reviewed and validated by RJK Consulting on a weekly basis. Spectral data are archived on a bi-monthly basis.

2.2 Additional Operations and Maintenance Items

Astaris continued to refine the air monitoring system to fit the unique application of the technology for the pond areas. Additional operations and maintenance items addressed for 2001 can be broken down into seven major categories; analysis methods and files, weather-related impact, instrumentation, hardware, meteorological, software, and on stream time.

2.2.1 Analysis Methods and Files

The analysis methods were modified a number of times throughout the year. All changes involved incorporation of different water vapor references to account for different temperature and water concentrations seen during the seasons.

Background files were periodically regenerated and installed on the FTIR systems throughout the year to accommodate the changing climate at the pond area.

A cold weather water reference was generated specifically for beam path 17-1F (northwest) and installed to accommodate the large shift that occurs during the initial generation of the single beam spectrum for that particular beam path. In addition, a revised Selene.exe file was also installed on this beam path to perform a double shift during quantitative analysis, which is needed due to the large shift.

The cold weather water reference generated for 17-1F (northwest) was installed on all beam paths during the 1st quarter of 2001. The water reference performed well on all beam paths. In addition, a new points file was generated and installed on all beam paths during this quarter.

New phosphine references were generated in a controlled laboratory environment for the generation of a calibration curve used in the linearization of the phosphine data from the ponds. A synthetic hydrogen cyanide reference set was also produced for establishing a linearization curve for HCN. Linearization of these compounds was included in a revised method instituted late in the 1st quarter 2001.

A new method was generated (Method 26) during the first part of the 2nd quarter 2001 and installed on all FTIR systems. This method was modified to account for Ozone (O_3) and facilitates in the analysis of target compounds.

Spectral data and concentration data were periodically downloaded from the FTIR computers and archived on CD-ROM disks. Hard drive data maintenance was performed on each computer to make room for additional data collection.

A modified method was generated (Method 05) during the last part of the 2nd quarter 2001 and installed on all FTIR systems. This method was modified to accommodate the hot summer weather conditions.

The default temperature for data quantification was changed seasonally to better accommodate the changing temperatures. The default temperature is used when the data link with the meteorological tower is lost.

A modified method (Method 26) was generated and installed during the first part of the fourth quarter 2001 to accommodate the change in weather by implementing water references compatible with the current weather conditions.

2.2.2 Weather–Related Impact

Steam from Pond 18-cell A affected on stream time during January, February, and March of 2001 and commenced again in November of 2001 continuing through December of 2001. Fog was also a contributor to downtime during November and December of 2001.

2.2.3 Instrumentation

Vertical and horizontal adjustments of the telescopes and the receivers continued to be periodically required to accommodate ground settling, vibration, housing expansion/ contraction effects, and high winds. Adjustments were made as required by tracking of path voltages without the need for shutdown of a system.

Biweekly to weekly, dependent on dust impact on beam path optics, superficial cleaning of 45-degree mirror surfaces and more substantial monthly cleaning were carried out which has helped to keep path voltages optimized.

An energy distribution test was performed on all 16 telescopes during the 1st Quarter of 2001. The test consisted of determining how the signal energy was being distributed among the telescopes. The tests showed that energy was not evenly distributed on most of the telescopes. Redistributing the energy evenly required a complete alignment of the laser using a white light source, which was completed as part of the quarterly maintenance. This maintenance resulted in maximum signal voltages as obtained during system startup in January 1999.

Instrument maintenance was carried out in April, October and December, which consisted of instrument telescope alignments, internal mirror alignments on both the transmitter and receiver telescopes to gain maximum signal energy, linearity and gain adjustments as necessary, thorough optical cleaning and internal diagnostic adjustments provided by the software.

A bi-annual gas audit was performed during the month of April and again during the month of October. The results of the two gas audits were previous reported in the quarterly reports covering the months of April and October.
Noise Equivalent Absorbance (NEA) tests were performed prior to preventive maintenance to judge whether the instruments were operating properly. This type of test is not a direct gauge of the quality of the data generated. The test indicated the need for complete internal and external alignments for a few beam paths as well as gain adjustments and linearity adjustments. These adjustments were made as part of quarterly maintenance.

The OP-FTIR computer's clocks were adjusted to Mountain Daylight Time during the first part of April and then to Mountain Standard Time at the end of October 2001.

A Sensa phone test was periodically conducted for purposes of checking the reliability of the alarm response system for phosphine and hydrogen cyanide exceedances. Any problems were dealt with immediately.

2.2.4 Hardware

First Quarter 2001

A fiber optic cable section had to be replaced during the period due to weak signal. This section ran from the fiber optic hub in the FTIR 181 building to a power pole. The link that was affected by the bad fiber optic cable was the link from all four FTIR computers to the main server in the annex. This also affected the link with the Phos Dock for alarm purposes (i.e. Data Relay program).

Four detectors were damaged during the period due to the liquid nitrogen tank dumping into the detector box, which damages the vacuum in the detector. This occurred on the receiver corner for 17-1E (southwest) and 17-2H (southeast). Replacement of all components for these two beam paths solved the problem with detector damage.

Auto-fill failures occurred periodically during the period. It is apparent that this occurs during seasonal changes (i.e. from colder to warmer temperatures). After recalibrations were performed on most auto-fill systems, no failures occurred.

High winds caused the telescope on beam path 18-2L (west) to vibrate which ultimately lost the signal for that beam path during high wind speeds. The downtime due to the high winds was reflected in the hourly data set for the 1st quarter 2001.

Solenoid valves were replaced as necessary to prevent damaging of detectors when the valves stick open during an auto-fill of the detector dewers.

Second Quarter 2001

FTIR computer clocks were periodically synchronized with the PH_3/HCN alarm system. This allowed for more accurate reporting of response times associated with FTIR recorded exceedance times.

Third Quarter 2001

Two detectors were replaced during the period due to vacuum failures in the detectors for beam paths 17-2G (northeast) and 18-1I (north). The vacuum failures were caused by excess liquid nitrogen flow into the detector compartment due to auto-fill system failures.

A lightning storm occurred on 7/8/2001 damaging an Optical Bench Control (OBC) board and detector for FTIR 18-2 and beam path 18-2K (south) respectively. The OBC board and detector were promptly replaced.

A lightning storm occurred a second time on 9/13/01 damaging an OBC board on FTIR 18-1 as well as a detector on beam path 18-1J (E). The OBC board and detector were replaced.

The 4Gb hard drives for all four FTIR computers were swapped out during the 3rd quarter 2001 with 8Gb hard drives.

A receiver box heater damaged a solenoid cable on beam path 17-1E (southwest) during August. The damaged cable caused several auto-fill failures on this beam path resulting in downtime. The cable was promptly replaced and no more failures have occurred since. Precautionary measures have been taken to assure that no more cables are damaged from the heaters.

An electrical short in a faulty solenoid on beam path 18-2L (west) was discovered during the month of September. This was causing interference in the OP-FTIR signal for that beam path, which resulted in some downtime for 18-2L (west). On 9/13/01 the entire solenoid was replaced, which fixed the problem.

Liquid nitrogen auto-fill systems periodically failed during the period. This prompted installation of newly refurbished phase separators at these failure sites to minimize downtime associated with the continual use of these systems.

A power outage occurred at the pond area on 9/15/01. All systems were functional when the power was re-established with no system lock ups.

Fourth Quarter 2001

Auto-fill system cryogenic fill lines were replaced with new cryogenic fill lines during the fourth quarter of 2001. The new fill lines are more efficient in the filling process and will result in fewer auto-fill failures.

All solenoid valves were replaced on all eight-beam paths with new solenoid valves to increase the efficiency and minimize failures.

Auto-fill systems were decommissioned during the last part of the 4th quarter 2001. Manual filling of all detector dewers commenced at this time. The manual fill program has proved to work very effectively.

A sliding mirror motor failed during December 2001 resulting in minimal downtime for one Pond 18 beam path. The part was promptly replaced and no downtime has been recorded since.

2.2.5 Meteorological

A performance and systems audit was carried out in May on the meteorological tower system with all parameters operating within specifications.

The meteorological tower functioned without error during the entire year of 2001 providing weather parameters necessary for OP-FTIR data analysis. There were periodic losses of the met-link at most OP-FTIRs, which resulted in the non-incorporation of Wind Speed, Wind Direction, Temperature, and Pressure data with the FTIR concentration data as well as the loss of communication with the Phos Dock for alarm response purposes. These occurrences were minimal and communications rapidly restored.

2.2.6 Software

PcANYWHERE32, which allows for remote access to the OP-FTIR systems, has continued to function efficiently during the year 2001.

ConcReporter continues to be an efficient tool for QA screening of the database for reporting.

2.2.7 On Stream Time

Astaris has established a goal of 95% on stream time for yearly data collection. Table 2.1.1 shows monthly and 2001 annual numbers reflecting system operability. Hardware problems inhibited on stream time the most, followed by adverse weather conditions, normal maintenance, and finally software problems. Table 2.1.2 shows downtime by reason per pond.

Table 2.1.1: On Stream Time per month/per pond 2001.

Month	Pond 17 – On Stream Time (%)	Pond 18- On Stream Time (%)
January	91.95	99.37
February	94.69	98.10
March	96.17	96.90
April	98.85	97.62
May	98.31	89.49
June	98.02	91.76
July	96.68	91.16
August	97.90	97.49
September	99.43	92.46
October	98.27	96.61
November	94.32	91.97
December	97.06	88.97
Annual (%)	**96.81**	**94.30**
Overall (%) (Both Ponds)	95.56	

Table 2.1.2: Downtime By Reason Per Pond for 2001.

Reason for Downtime	Pond 17 (%) downtime	Pond 18 (%) downtime
Quality Assurance	0.12	0.09
Software/Hardware Maintenance	0.51	0.62
Software Problems	0.35	0.32
Hardware Problems	1.63	3.29
Construction	0.17	0.03
Empty Liquid Nitrogen Tank	0.08	0.09
Power Outages	0.01	0.01
Weather	0.32	1.25

Section 3 - DATA PRESENTATION and ANALYSIS

3.1 Summary of Annual Data

This subsection provides a summary discussion of the annual data collected on a monthly basis. Table 3.1-1 provides the average and maximum concentrations, based on hourly data, for the year by pond area for all target compounds, and Table 3.1-2 provides the exceedances for PH_3 for 2001 based on the hourly averaged data. There were no exceedances for HCN and therefore no table is provided.

Figure 3.1.a, 3.1.b, 3.1.c, and 3.1.d provide the wind roses presenting wind speed and wind direction data for all four quarters of 2001.

Table 3.1-1: Maximum and Average PPM concentration values for 2001.

POND	PH3 max.	PH3 avg.	HCN max.	HCN avg.	NH3 max.	NH3 avg.	CH4 max.	CH4 avg.
17	3.03	0.11	1.09	0.13	0.65	0.03	4.79	1.85
18	2.14	0.03	1.18	0.04	0.65	0.01	4.84	2.02

Table 3.1-2: PH_3 Exceedances for 2001 based on Hourly Averaged Data

Item Number	Beam Path	Location	Timestamp	Phosphine Concentration	Wind Speed	Wind Direction	Cell Temp.
1	17-2G	northeast	03/25/01 04:00	1.07	3.11	238.69	2.61
2	17-2G	northeast	04/01/01 20:00	1.22	3.98	198.02	6.32
3	17-1F	northwest	04/18/01 20:00	1.63	1.37	196.45	11.39
4	18-1J	east	04/18/01 20:00	2.14	1.36	194.73	11.54
5	17-2G	northeast	04/30/01 20:00	1.26	11.27	206.04	18.62
6	17-1F	northwest	05/23/01 03:00	1.00	2.13	106.20	7.80
7	17-2H	southeast	06/30/01 03:00	1.02	0.14	296.01	14.12
8	17-2H	southeast	07/28/01 00:00	1.57	3.74	292.43	20.68
9	17-2G	northeast	07/29/01 21:00	1.09	1.43	166.90	19.50
10	17-2H	southeast	07/30/01 00:00	1.95	0.51	243.89	12.71
11	17-2G	northeast	07/30/01 00:00	1.41	0.81	176.89	12.37
12	17-2G	northeast	08/07/01 20:00	2.58	2.77	206.47	27.90
13	17-2G	northeast	08/08/01 04:00	1.44	2.72	193.90	18.21
14	17-1F	northwest	08/14/01 20:00	1.02	1.57	149.95	23.43
15	17-2H	southeast	08/15/01 19:00	3.03	7.05	264.87	26.19
16	17-1F	northwest	08/18/01 23:00	1.24	0.41	92.90	15.25
17	17-1F	northwest	08/24/01 01:00	1.02	0.91	194.04	11.57
18	17-1F	northwest	08/26/01 20:00	1.02	1.77	128.74	23.88
19	17-2G	northeast	09/03/01 19:00	1.26	2.94	263.80	26.01

20	17-2H	southeast	09/03/01 21:00	1.31	0.70	42.38	19.54
21	18-1J	east	09/11/01 02:00	1.58	1.51	143.32	6.71
22	17-1F	northwest	09/26/01 19:00	1.76	1.51	127.06	16.62
23	17-1F	northwest	09/27/01 00:00	1.33	0.60	51.93	7.39
24	18-1J	east	09/27/01 00:00	1.19	0.51	74.05	7.32
25	17-2G	northeast	09/28/01 18:00	1.02	5.19	227.12	20.65
26	17-2H	southeast	10/28/01 04:00	1.28	0.28	299.96	0.80
27	17-2G	northeast	10/28/01 16:00	1.04	4.56	238.68	14.82
28	17-1F	northwest	10/28/01 23:00	1.60	1.14	293.81	3.21
29	17-2G	northeast	10/28/01 23:00	1.21	1.15	293.52	3.16
30	17-2H	southeast	10/29/01 00:00	1.09	1.08	54.03	5.03
31	17-1F	northwest	10/30/01 04:00	1.55	1.08	231.25	8.29
32	17-1F	northwest	11/04/01 17:00	1.01	2.00	121.44	10.43
33	18-1J	east	11/13/01 01:00	1.43	1.62	147.30	0.45

Legend: Concentration in Parts Per Million (PPM)
Wind Speed in Miles Per Hour (mph)
Wind Direction in Degrees from North
Ambient Temperature in Degrees Celsius

3.1.1 Annual Data Discussion

Review of maximums and annual averages for the program target compounds indicates that the highest PH_3 concentration was seen at Pond 17. Pond 17 also had the highest annual PH_3 average. Pond 17 was active from the late spring through early November and sporadically active the rest of the time. Pond 18 showed some moderate PH_3 emissions during the late spring and summer with sporadic emissions during the remainder of the year due to pond discharges and pH changes.

There were some high intermittent HCN emissions as evidenced by maximums from both ponds exceeding 1.0 PPM. The average HCN concentration for Pond 17 was greater than the average for Pond 18 by a factor of three.

Most of the NH_3 impacts monitored around the ponds came from non-pond sources, mainly to the NE-ENE, SW, and NW, which accounted for the vast majority of all moderate to high NH_3 concentrations measured at the ponds. The annual average NH_3 concentrations show Pond 17 emissions greater than Pond 18. Nevertheless, NH_3 emissions from Pond 17 were considered low to moderate with minimal NH_3 emissions from the Pond 18 area.

Somewhat higher [and more numerous spikes] CH_4 maximums and average concentrations were seen at Pond 18 - likely due to the plume impacts from railroad traffic at this location during the year [especially the north path]. There was some evidence this year of minor CH_4 emissions from the active ponds.

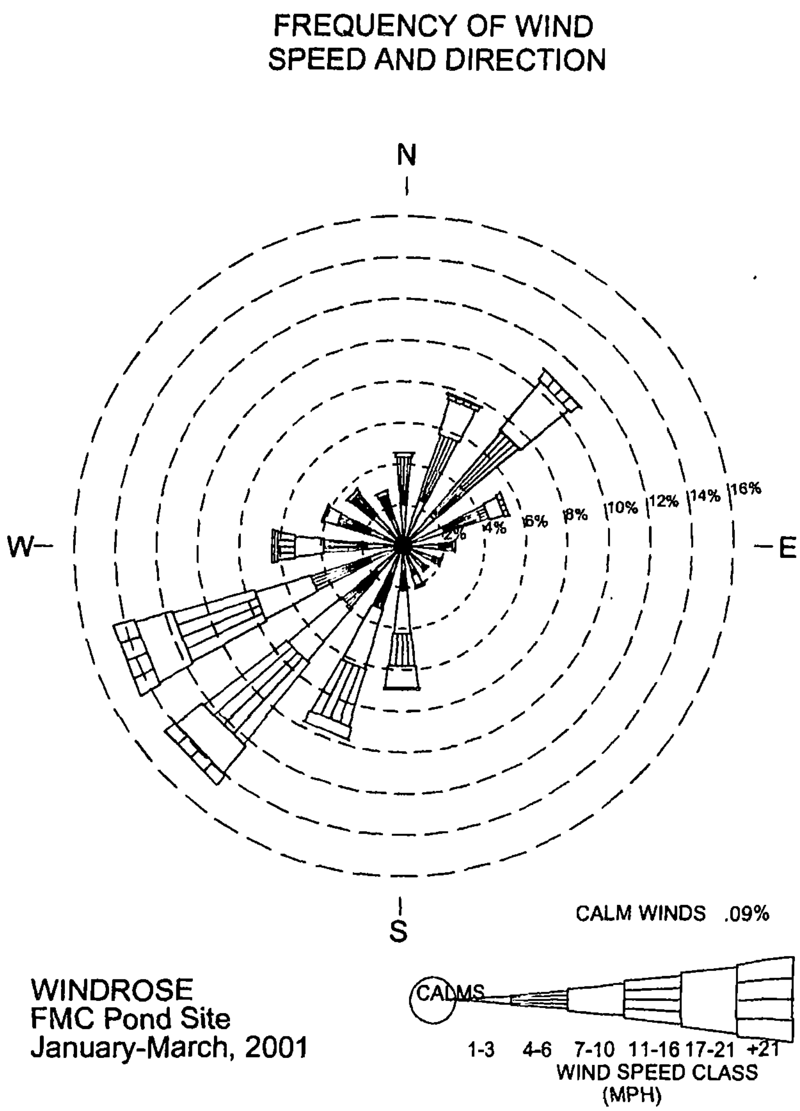
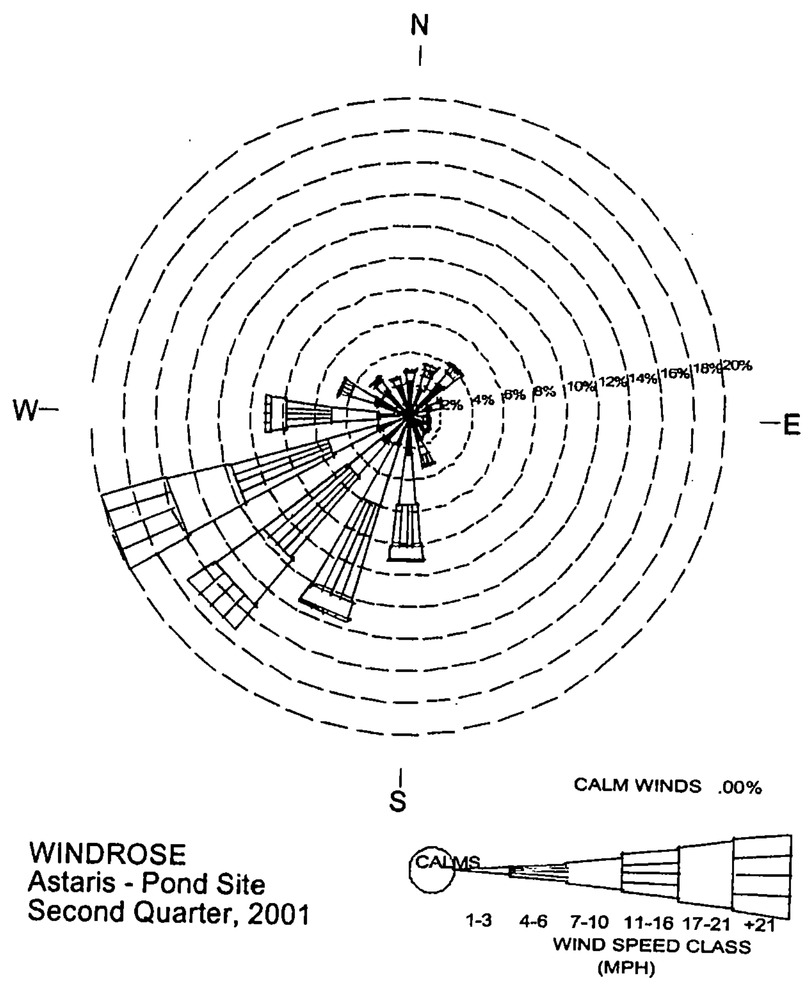

FREQUENCY OF WIND
SPEED AND DIRECTION
N
W
E
S
2%
4%
6%
8%
10%
12%
14%
16%
CALM WINDS .09%
CALMS
1-3 4-6 7-10 11-16 17-21 +21
WIND SPEED CLASS
(MPH)
WINDROSE
FMC Pond Site
January-March, 2001

Figure 3.1.a

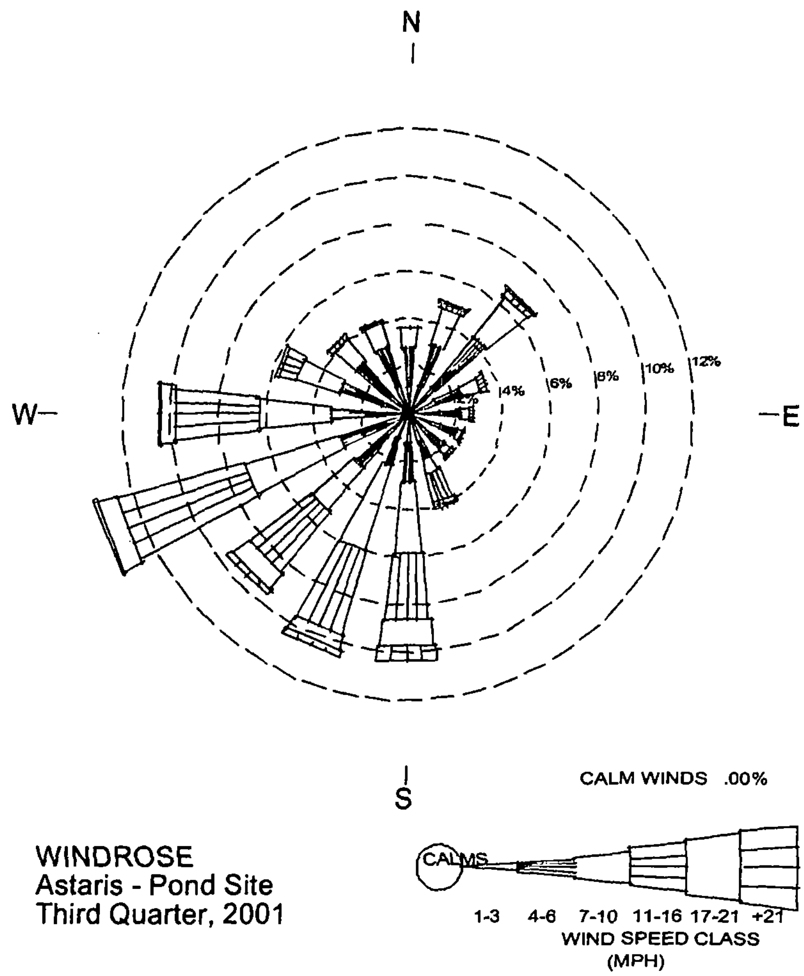
FREQUENCY OF WIND
SPEED AND DIRECTION



WINDROSE
Astaris - Pond Site
Second Quarter, 2001

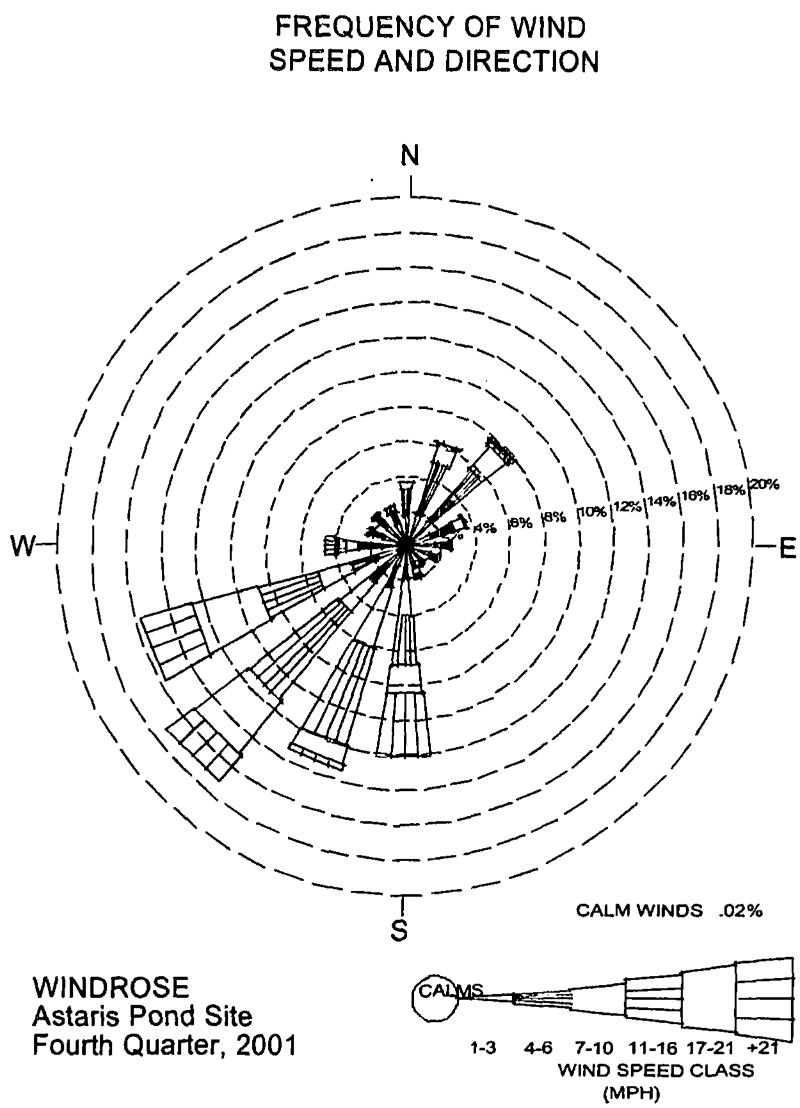
Figure 3.1.b

FREQUENCY OF WIND
SPEED AND DIRECTION



WINDROSE
Astaris - Pond Site
Third Quarter, 2001

Figure 3.1.c



WINDROSE
Astaris Pond Site
Fourth Quarter, 2001

Figure 3.1.d

CO spiking remained at low levels with average CO concentrations far below national air quality standards.

3.1.2 Meteorological Data

A portion of the pond tower meteorological data [wind speed, wind direction, temperature, and air pressure] were combined with each 5-minute OP-FTIR data point through the system met-link and were archived with this data for future analysis. The pressure and temperature data were used to correct component concentrations based on reference conditions to actual conditions using the OP-FTIR operational software. The wind speed and direction data were used for producing pollution roses. The meteorological data were also archived in 15-minute segments for the year, used to produce wind rose plots, and saved for future analysis. Figure 3.1.a through 3.1.d are the wind rose plots for the four quarters of 2001.

A summary of the wind roses indicates an overall similar wind pattern for the first and fourth quarters with major SSW to WSW sector winds and substantial NNE-NE sector winds with fairly similar wind speed distributions. The second quarter showed the relative absence of NNE to NE winds with most winds coming from the S to W. The third quarter showed continuation of S to W winds but with some NE to NNE winds and very minor SSE and WNW winds. The highest winds were seen in the Third Quarter. Calm winds only accounted for less than 0.11 % of all winds during the year. Winds of 1-3 mph were most frequently in the First Quarter and accounted for nearly 25% of all winds in this quarter and about 19% of all winds for the year.

3.2 Specific Data Analysis

3.2.1 Action Level Exceedances and Exceedance Evaluations

There were no exceedances for HCN during the year.

The hourly PH_3 exceedances for 2001, provided by Table 3.1.2, shows the total exceedances with a majority [54.5%] occurring during warmest weather months in the Third Quarter. There was only one PH_3 exceedance seen in the First Quarter, six in the Second Quarter and eight exceedances in the Fourth Quarter. Most PH_3 exceedances were characterized by light wind conditions typically found in the late p.m. and early a.m. hours. About 24% of all exceedances occurred when winds were greater than 2.8 mph.

Light wind conditions confined PH_3 impacts to the immediate pond area due to lack of air transport conditions. There were only a few cases seen of PH_3 build-up followed by rapid wind speed build-up to moderate levels, which allowed for transport beyond the pond boundaries followed by rapid dilution due to atmospheric dispersion. Most PH_3 exceedances under higher wind speeds can be directly attributed to Pond 17. Emissions from Pond 18-cell A were only a very minor contributor to the monitored exceedances.

3.2.2 Annual Pollution Rose Discussions

Figures 3.2.a through 3.2.g are pollution roses that depict component-specific information and are helpful in understanding the sources and source variations for components being measured in the program. A brief discussion of the pollution roses presented follows. Note that each pollution rose provides an approximate 100% of scale value shown as part of the legend. The values shown are in Parts Per Million (PPM). Also, reviewers should know that some due north values on the figures result from the software using a default wind direction of north during malfunctions.

Figures 3.2.a through 3.2.c provide HCN pollution roses. The 3.2.a and 3.2.b Figures are for Pond 17 paths (northeast) and (southeast) respectively. Figure 3.2.a shows some minor impacts from the NE sector. The majority of HCN is seen coming from the WSW to SSW due to Pond 17 emissions while HCN impacts from the W to NW are due to Pond 18-cell A emissions. Figure 3.2.b shows most of the impact from the NW sector due the combined Pond 17 and 18-cell A emissions with some HCN seen from the WSW to SW from part of Pond 17. Figure 3.2.c for the Pond 18-1J (east) path shows most HCN impact from the WSW to SSW due to Pond 18-cell A emissions and the predominant SW flow pattern. There is some HCN seen from the SE due to Pond 17 emissions while only minor effects are seen from the E to ENE.

Figures 3.2.d and 3.2.e provide PH_3 pollution roses for the Pond 18-1I (north) and Pond 17-1F (northwest) paths, respectively. Figure 3.2.d indicates that most elevated PH_3 was seen from the ESE to S. There is some PH_3 seen from the SSW from Pond 18-cell A. Figure 3.2.e shows some elevated PH_3 from the N to NE. The majority of PH_3 is seen from the SE to SSW from Pond 17 emissions. There is a trace of PH_3 seen from the WNW to W from Pond 18-cell A emissions.

Figure 3.2.f provides a CO pollution rose for the 18-1I (north) path. CO is seen from all wind directions. The CO is coming from non-pond sources such as trains, highway, local point sources, and at times from pond vehicular traffic. The ponds do not emit CO. The highest CO is seen from the NE with some elevated CO from the NW and SW to SSW.

Figure 3.2.g is pollution rose for NH_3 for the Pond 17-1F (northwest) path showing most elevated NH_3 concentrations coming from the SE to SSW reflecting Pond 17 emissions and some minor non-pond sources. Some stronger impacts were observed from the NE to NNE and from the SW reflecting other NH_3 sources offsite.

3.2.3 Hydrogen Fluoride Assessment

The following table indicates the working detection limits [WDL] for hydrogen fluoride (HF) in spectra reviewed for quality assurance purposes. Data spectra refer to those spectra that were part of the validated data set. Differential spectra refer to spectra that were formed using another data spectra as background to reduce the impact from baseline curvature, water vapor, and carbon dioxide.

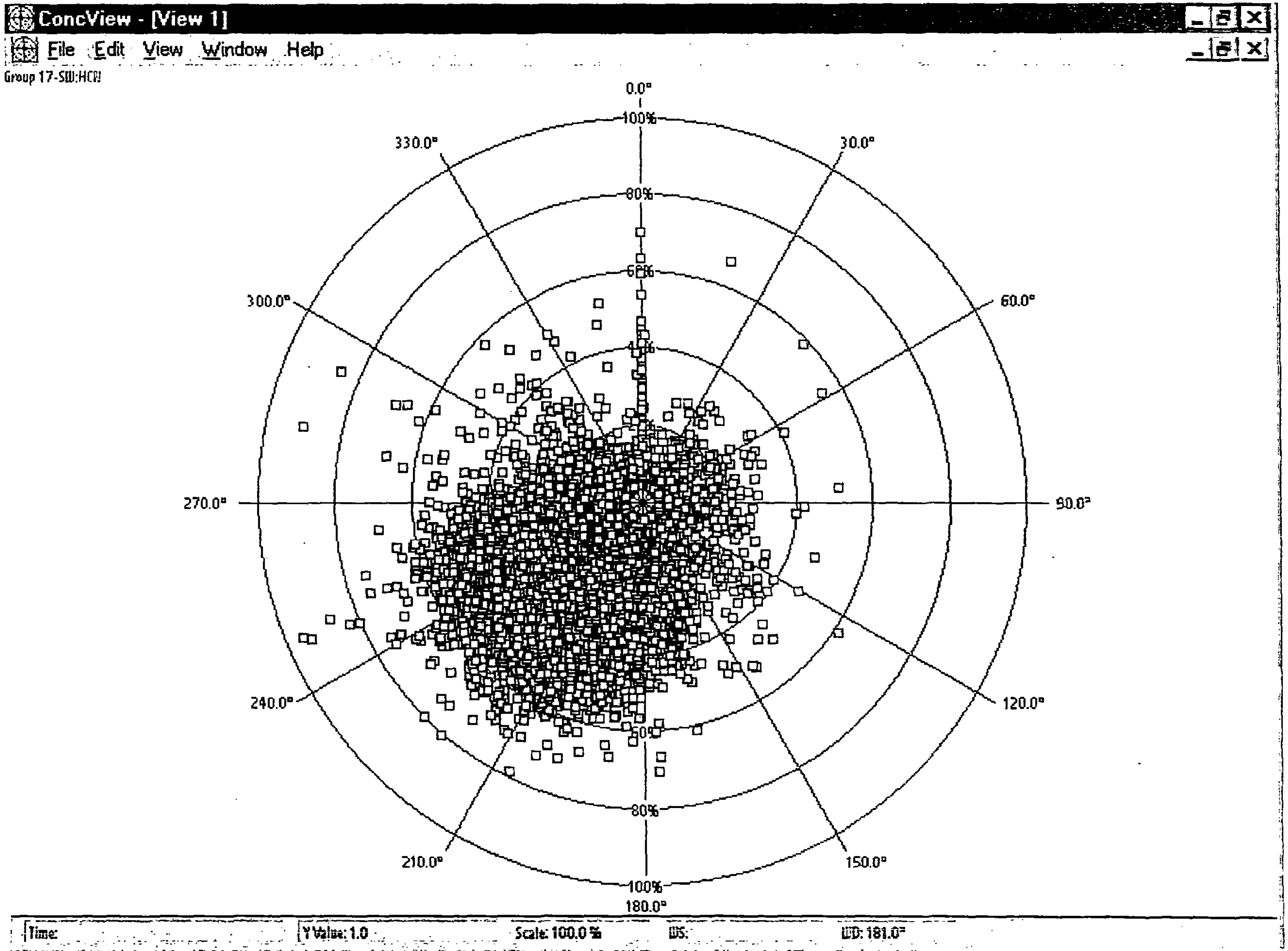


Figure 3.2.a: **HCN Pollution Rose [17-2G northeast path]**

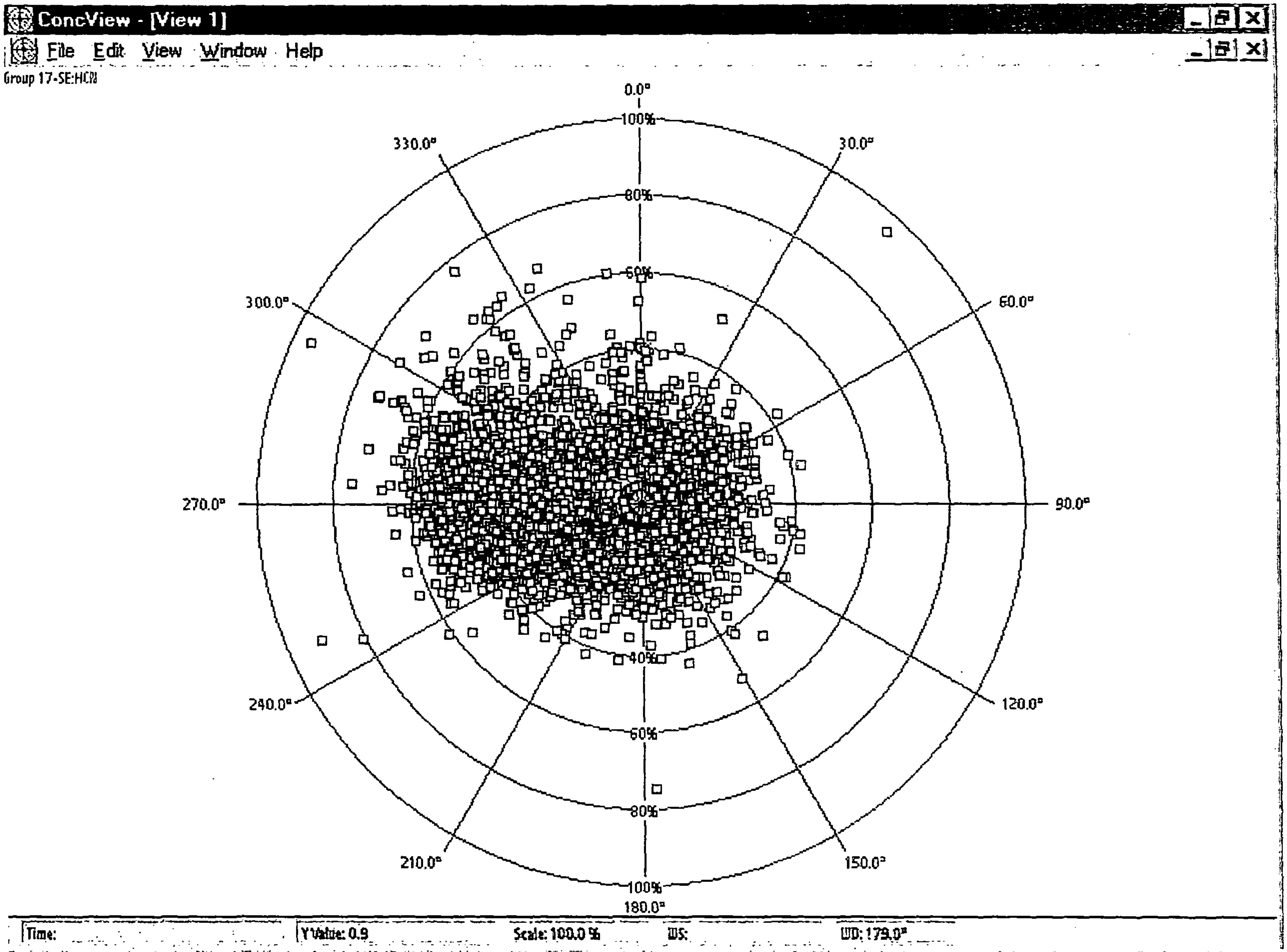


Figure 3.2.b: **HCN Pollution Rose [17-2H southeast path]**

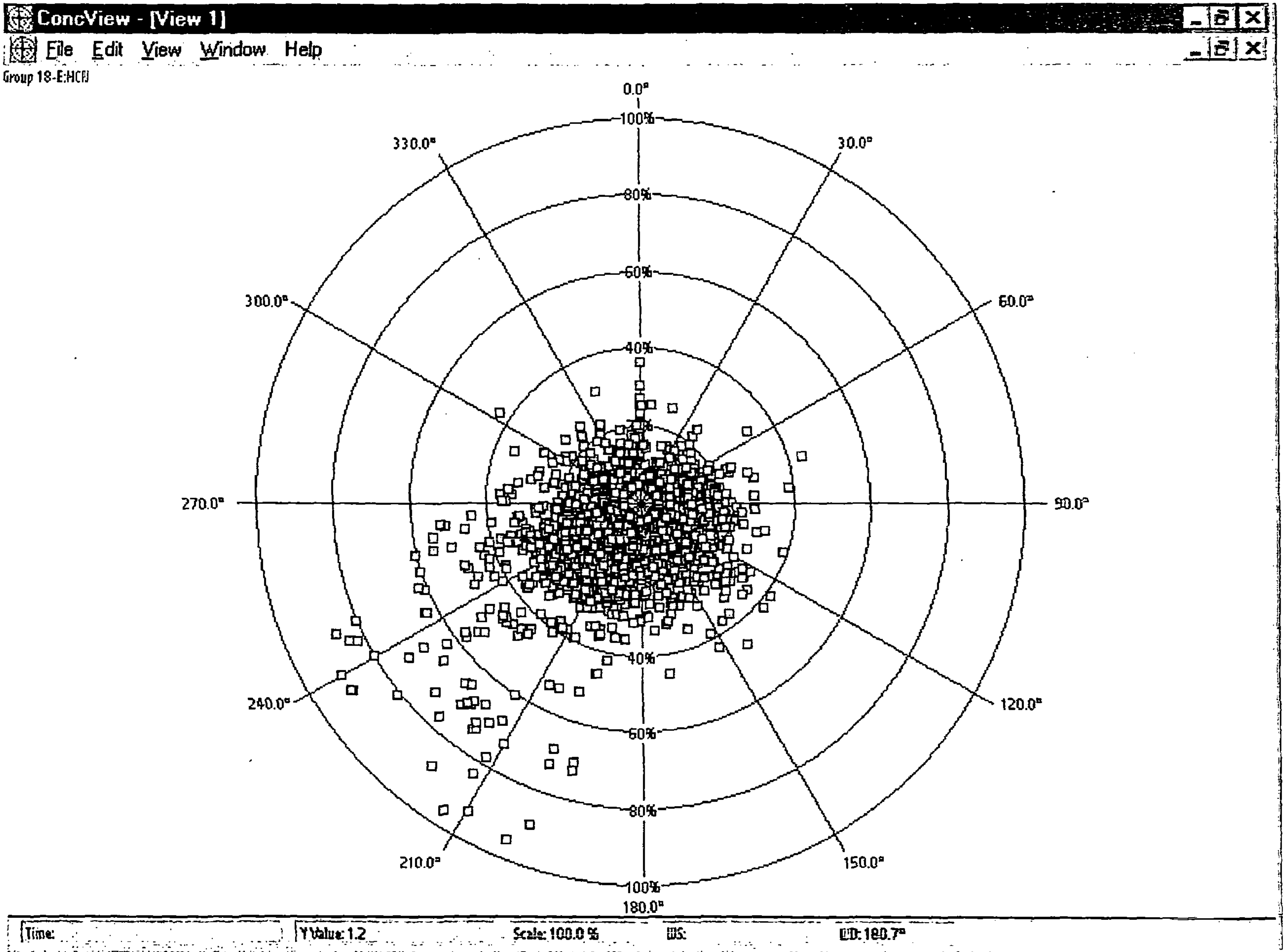


Figure 3.2.c: **HCN Pollution Rose [18-1J east path]**

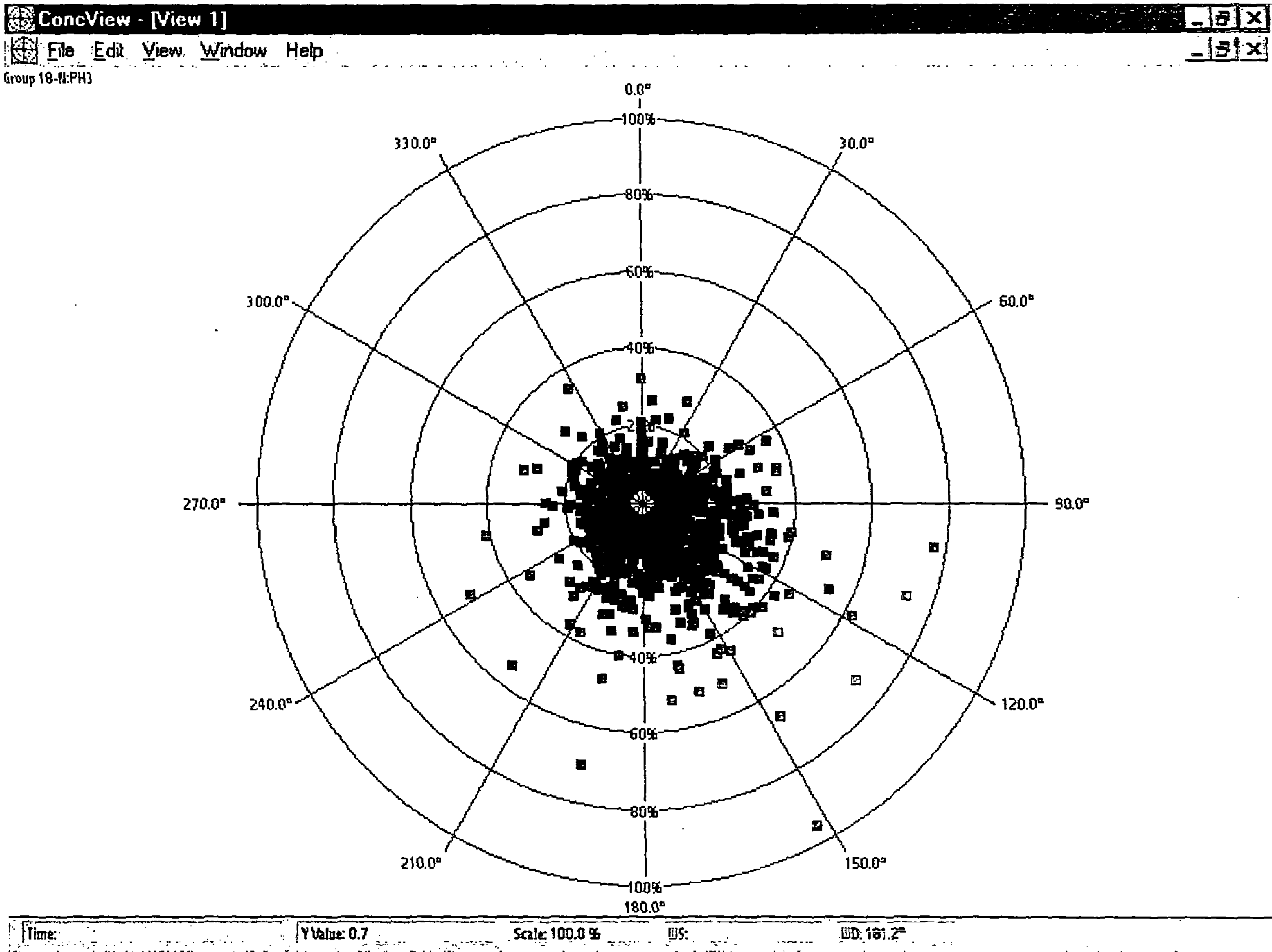


Figure 3.2.d: PH_3 Pollution Rose [18-1I north path]

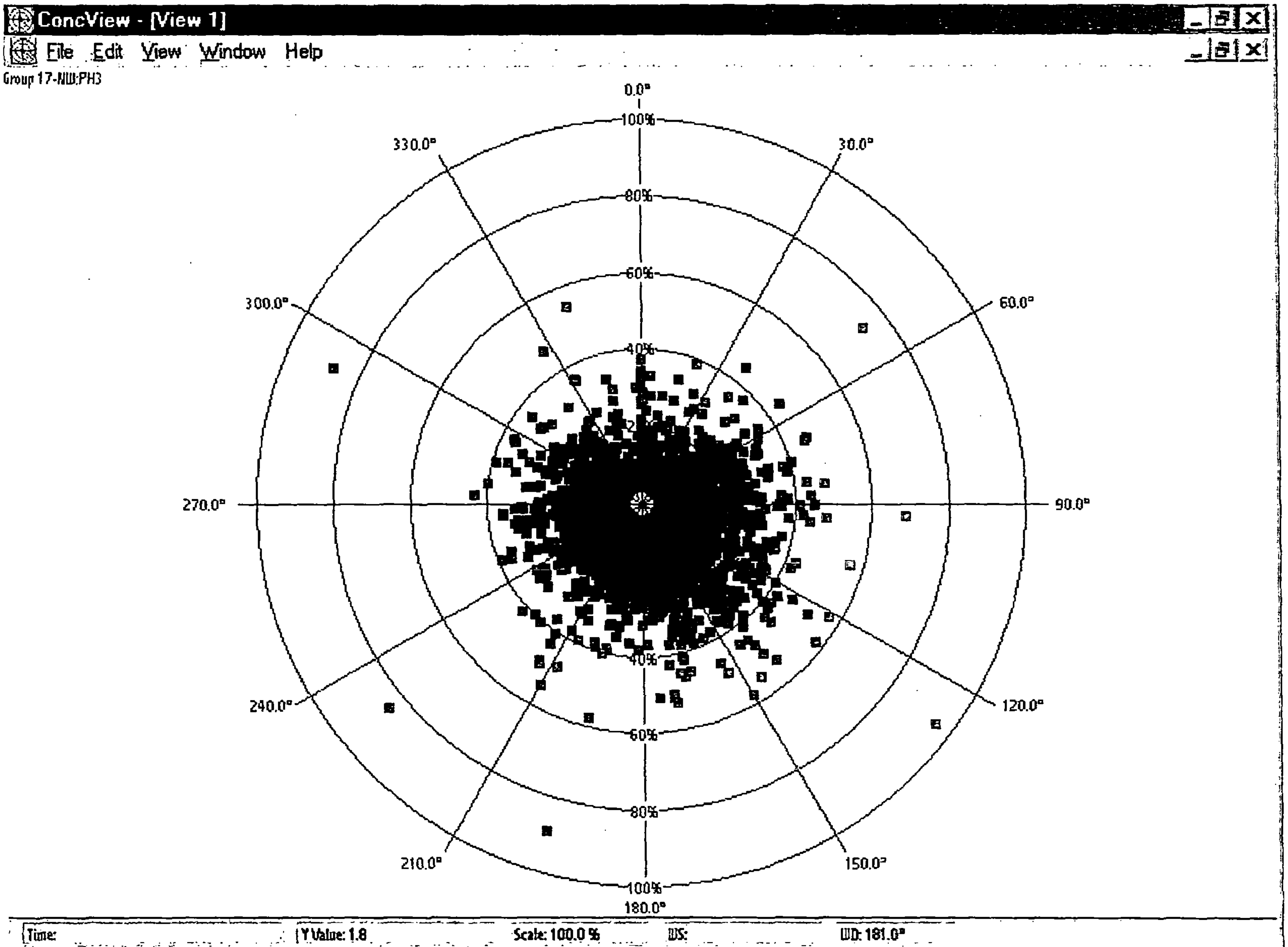


Figure 3.2.e: **PH_3 Pollution Rose [17-1F northwest path]**

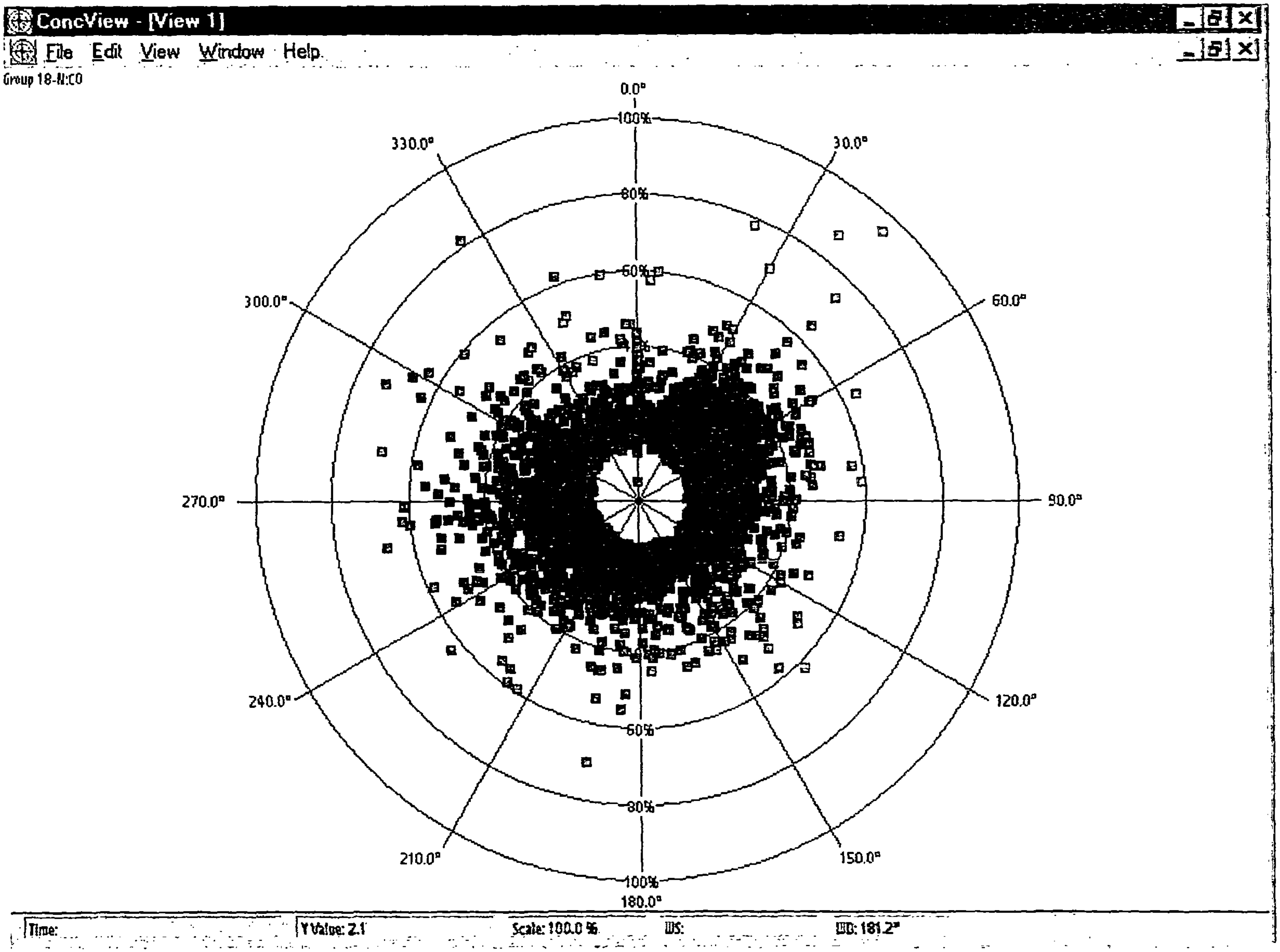


Figure 3.2.f: CO Pollution Rose [18-1I north path]

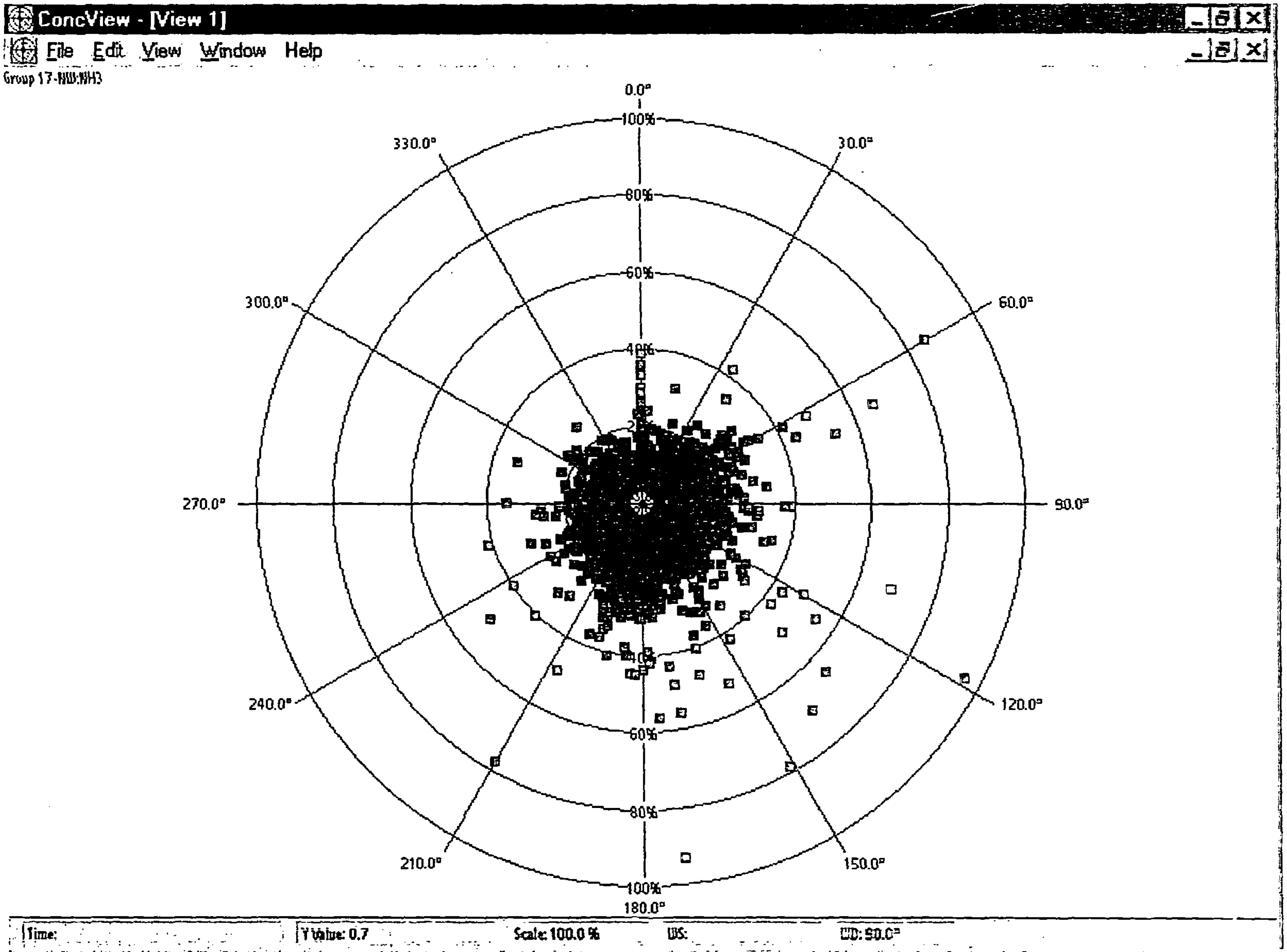


Figure 3.2.g: **NH_3 Pollution Rose [17-1F northwest path]**

Table Of Working Detection Limits [WDL] For Hydrogen Fluoride

Month	WDL range-data spectra		WDL range-differential spectra	
January	0.021-0.345	PPM	0.007-0.102	PPM
February	0.023-0.201	PPM	0.006-0.207	PPM
March	0.014-0.200	PPM	0.009-0.067	PPM
April	0.016-0.252	PPM	0.011-0.113	PPM
May	0.018-0.389	PPM	0.016-0.280	PPM
June	0.026-0.333	PPM	0.018-0.228	PPM
July	0.012-0.467	PPM	0.009-0.322	PPM
August	0.030-0.329	PPM	0.010-0.214	PPM
September	0.012-0.226	PPM	0.012-0.161	PPM
October	0.016-0.250	PPM	0.007-0.133	PPM
November	0.018-0.257	PPM	0.013-0.144	PPM
December	0.019-0.235	PPM	0.012-0.109	PPM
Yearly Average	**0.089 PPM**		**0.047 PPM**	

There were seven tentative HF detections seen during 2001. Date validation confirmed four HF detections, which ranged from 0.015 PPM to 0.051 PPM. The most likely source for the monitored HF concentrations would be the gypsum pond operated by Simplot – this source is located to the SE of the pond area.

Section 4 - QUALITY ASSURANCE

4.1 General Discussion

Quality assurance for the program includes data evaluation using TO-16 parameters on an on-going and interactive basis. Evaluation results may dictate the need for instrumentation maintenance or adjustment. QA/QC also includes some cursory data validation on a weekly or semiweekly basis, and semiannual system and performance audits. The data from the audits was used for data precision and accuracy assessment.

Weekly the OP-FTIR data was independently reviewed using the Unisearch ConcView software program. This software allows for rapid cursory review of the entire weekly data set. The results of the review were used to flag periods of marginal or unacceptable data for evaluation and to provide information for corrective actions.

4.2 Spectral Validation

A minimum of one spectrum and in most cases two or more spectra per operational beam path were independently validated each week to confirm instrument acceptability, target compounds present, and concentrations of key target compounds. The results of the review were used to flag periods of marginal or unacceptable data for evaluation and to provide information for corrective actions.

Concentration values were verified by use of alternate FTIR analyses methods/regions than used for the Astaris program or by calculating the area under a data sample peak and comparing this area to the area under the same peak for a reference spectrum of known concentration. The ratio of areas and pathlengths times the known reference concentration value yields a calculated data spectrum concentration.

Additionally some differential spectra were formed from sample spectra close in time or in water vapor concentration for a beam path location but with moderate to significant differences in some target compounds. Because water and CO_2 match up very well, the resultant absorbance spectra have much better resolution of remaining components and much lower working detection levels for compounds. The differential spectra were used to confirm some target compound concentrations, and to check for the presence of unidentified peaks from other possible compounds.

4.3 Nitrous Oxide (N_2O) and Delta Voltage

N_2O and delta voltages were looked at on a daily basis and were used to confirm suspect or invalid data periods. These periods were investigated and data invalidated as necessary. Corrective actions were taken for any problems identified. Values exceeding ~15% deviation from the mean were investigated for N_2O and values of less than 1.0 volt delta voltage were investigated. The absolute value of N_2O is extremely sensitive to background; therefore the mean value will be different for each background.

Figures 4.3.a and 4.3.b depict Nitrous Oxide for the year 2001 on a daily averaged basis. Figures 4.3.c and 4.3.d depict Delta Voltage for the year 2001 on a daily averaged basis.

Figures 4.3.a and 4.3.b depict changes in N_2O values for Ponds 17 and 18. The changes to the N_2O values occurred when either new background files were generated, or a quantitation method was changed. These modifications occurred during the months of February, April, June, July, October and November.

Major telescope alignments were performed in June, October and December during times of instrument maintenance. These alignments can be seen as an increase in delta voltage in Figures 4.3.c and 4.3.d. Other increases observed in Figures 4.3.c and 4.3.d were from optical cleaning and minor telescope alignments.

4.4 System and Performance Audit Results

System and performance audits were conducted in April and October of 2001. The results of the acceptance testing and system and performance audits are detailed in quarterly report documents during the time frame in which they were performed. On average, both ponds met or exceeded the project goals established for accuracy and precision. There were one or two individual paths that exceeded precision goals slightly, but these cases were explainable due to high target compound background fluctuations during the testing. The systems audits showed no serious deficiencies in operation, and any minor deficiencies noted were generally rectified within a short time following the reporting of audit findings.

Nitrous Oxide - Pond 17 (2001)

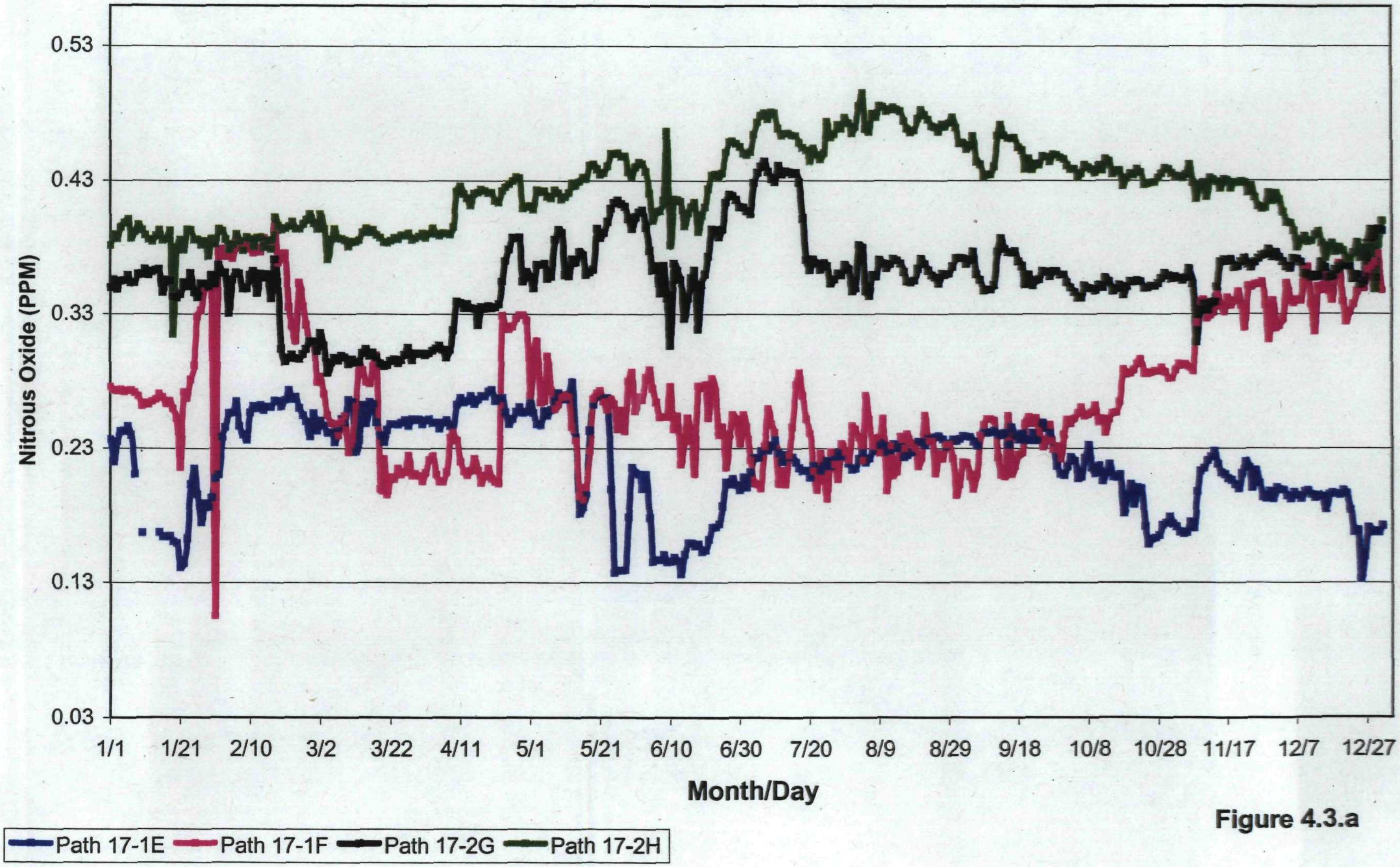


Figure 4.3.a

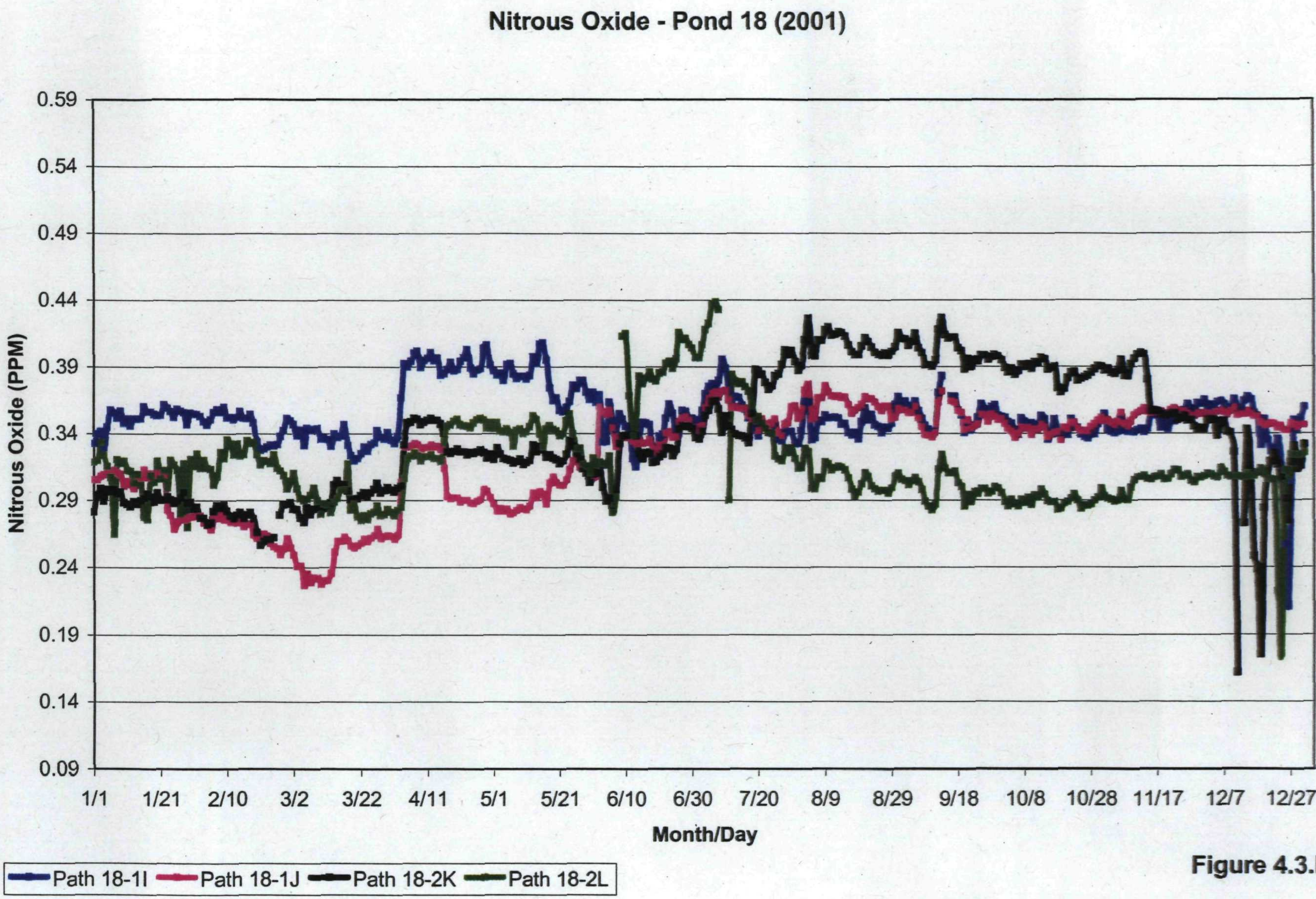

Nitrous Oxide - Pond 18 (2001)
0.59
0.54
0.49
0.44
0.39
0.34
0.29
0.24
0.19
0.14
0.09
Nitrous Oxide (PPM)
1/1
1/21
2/10
3/2
3/22
4/11
5/1
5/21
6/10
6/30
7/20
8/9
8/29
9/18
10/8
10/28
11/17
12/7
12/27
Month/Day
Path 18-1I
Path 18-1J
Path 18-2K
Path 18-2L

Figure 4.3.b

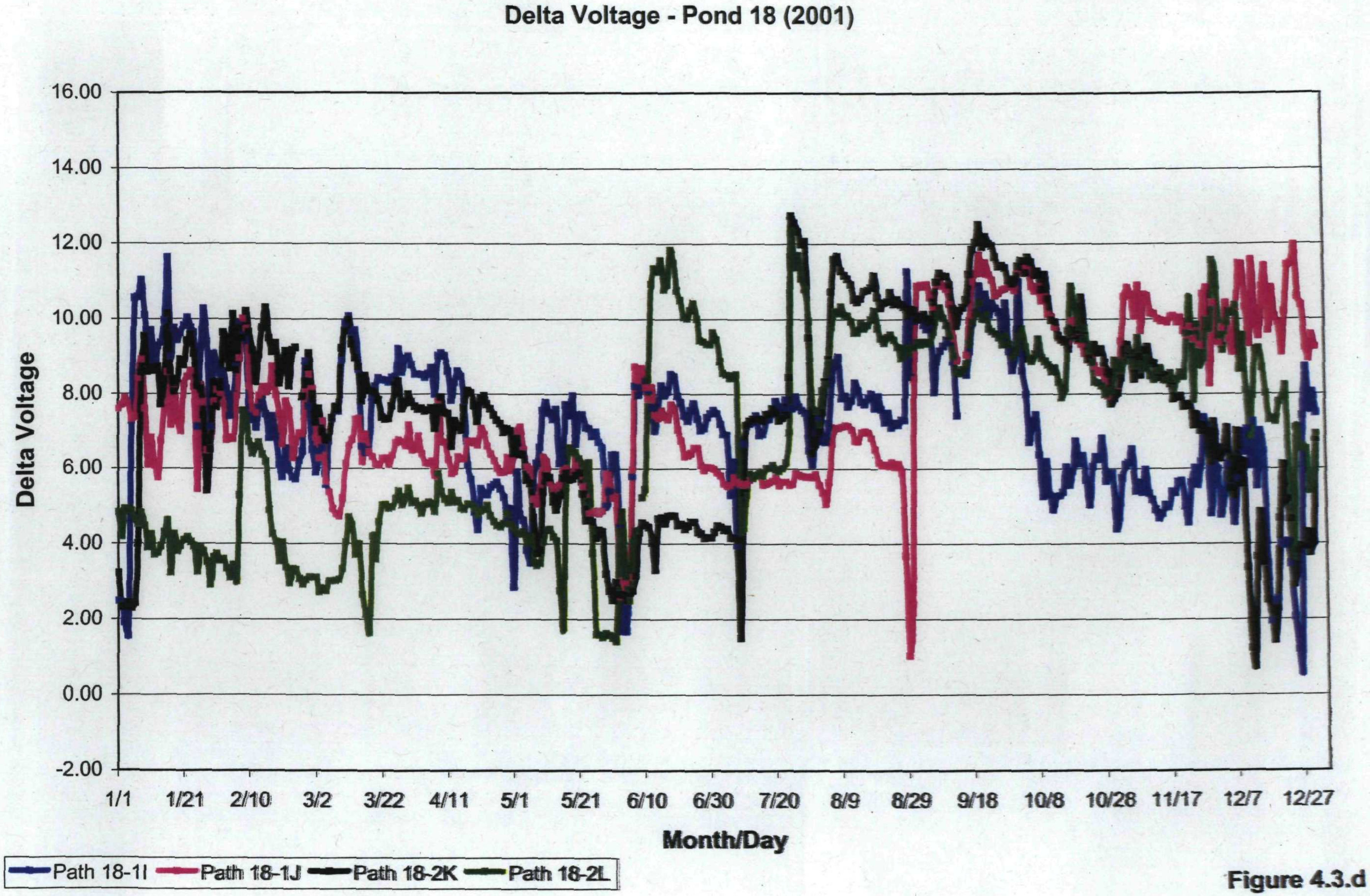
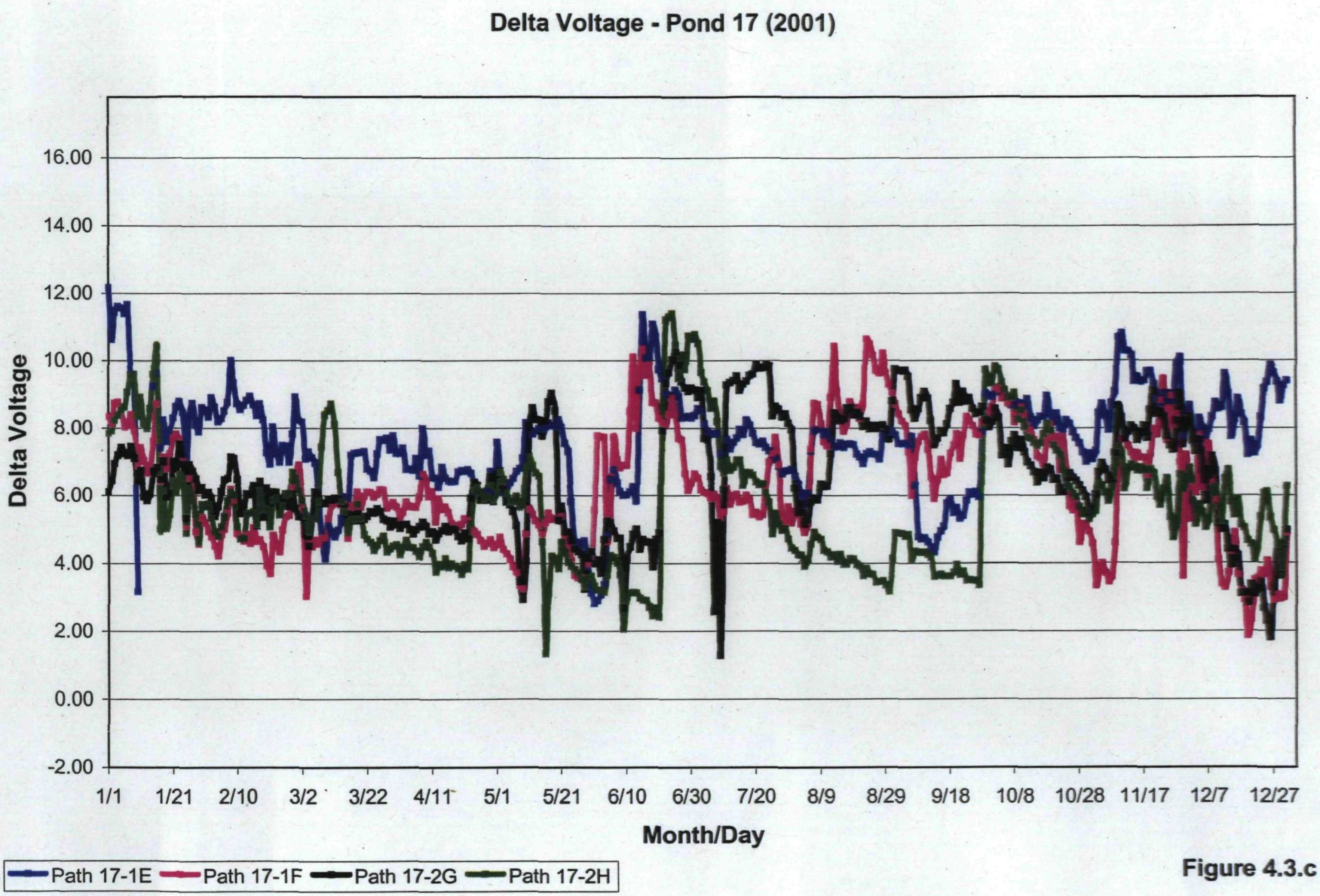

Delta Voltage - Pond 18 (2001)
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
Delta Voltage
1/1
1/21
2/10
3/2
3/22
4/11
5/1
5/21
6/10
6/30
7/20
8/9
8/29
9/18
10/8
10/28
11/17
12/7
12/27
Month/Day
Path 18-1I
Path 18-1J
Path 18-2K
Path 18-2L

Figure 4.3.d



Delta Voltage - Pond 17 (2001)
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-2.00
Delta Voltage
1/1
1/21
2/10
3/2
3/22
4/11
5/1
5/21
6/10
6/30
7/20
8/9
8/29
9/18
10/8
10/28
11/17
12/7
12/27
Month/Day
Path 17-1E
Path 17-1F
Path 17-2G
Path 17-2H

Figure 4.3.c